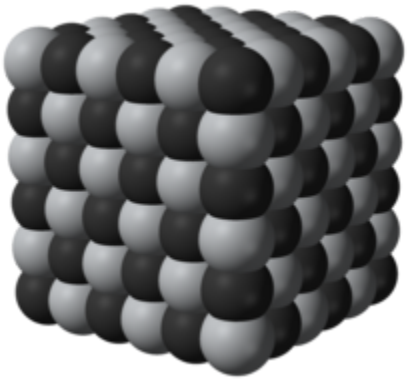
Titanium carbide

Titanium carbide, TiC, is an extremely hard (Mohs 9–9.5) refractory ceramic material, similar to tungsten carbide. It has the appearance of black powder with the sodium chloride (face-centered cubic) crystal structure.

Titanium carbide



Names

IUPAC name
titanium carbide

Other names
titanium(IV) carbide

Identifiers

CAS Number	12070-08-5 (https://commonchemistry.cas.org/detail?cas_rn=12070-08-5) ✓
3D model (JSmol)	Interactive image (https://chemapps.stolaf.edu/jmol/jmol.php?model=%5BTi%2B%5D%23%5BC-%5D)
ECHA InfoCard	100.031.916 (https://echa.europa.eu/substance-information/-/substanceinfo/100.031.916)
PubChem CID	4226345 (https://pubchem.ncbi.nlm.nih.gov/compound/4226345)
UNII	7SHTGW5HBI (https://fdasis.nlm.nih.gov/srs/srsdirect.jsp?regno=7SHTGW5HBI) ✓
CompTox Dashboard (EPA)	DTXSID10583531 (https://comptox.epa.gov/dashboard/chemical/details/DTXSID10583531)

InChI
InChI=1S/C.Ti/q-1;+1

SMILES
[Ti+]#[C-]

Properties	
Chemical formula	TiC
Molar mass	59.89 g/mol
Appearance	black powder
Density	4.93 g/cm^3
Melting point	3,160 °C (5,720 °F; 3,430 K)
Boiling point	4,820 °C (8,710 °F; 5,090 K)
Solubility in water	insoluble in water
Magnetic susceptibility (χ)	+8.0·10^{-6} cm^3/mol
Structure	
Crystal structure	Cubic, cF8
Space group	Fm$\bar{3}$m, No. 225
Coordination geometry	Octahedral

Except where otherwise noted, data are given for materials in their standard state (at 25 °C [77 °F], 100 kPa).

✗ verify (https://en.wikipedia.org/w/index.php?title=Special:ComparePages&rev1=441066916&page2=Titanium+carbide) (what is ✓✗ ?)

Infobox references

It occurs in nature as a form of the very rare mineral **khamrabaevite** (Russian: Хамрабаевит) - (Ti,V,Fe)C. It was discovered in 1984 on Mount Arashan in the Chatkal District,[1] USSR (modern Kyrgyzstan), near the Uzbek border. The mineral was named after Ibragim Khamrabaevich Khamrabaev, director of Geology and Geophysics of Tashkent, Uzbekistan. As found in nature its crystals range in size from 0.1 to 0.3mm.

Physical properties

Titanium carbide has an elastic modulus of approximately 400 GPa and a shear modulus of 188 GPa.[2]

Manufacturing and machining

Tool bits without tungsten content can be made of titanium carbide in nickel-cobalt matrix cermet, enhancing the cutting speed, precision, and smoothness of the workpiece.

The resistance to wear, corrosion, and oxidation of a tungsten carbide–cobalt material can be increased by adding 6–30% of titanium carbide to tungsten carbide. This forms a solid solution that is more brittle and susceptible to breakage.

Titanium carbide can be etched with reactive-ion etching.

Applications

Titanium carbide is used in preparation of cermets, which are frequently used to machine steel materials at high cutting speed. It is also used as an abrasion-resistant surface coating on metal parts, such as tool bits and watch mechanisms.[3] Titanium carbide is also used as a heat shield coating for atmospheric reentry of spacecraft.[4]

7075 aluminium alloy (AA7075) is almost as strong as steel, but weighs one third as much. Using thin AA7075 rods with TiC nanoparticles allows larger alloys pieces to be welded without phase-segregation induced cracks.[5]

See also

- Metallocarbohedryne, a family of metal-carbon clusters including Ti_8C_{12}

References

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3. *Gupta, P.; Fang, F.; Rubanov, S.; Loho, T.; Koo, A.; Swift, N.; Fiedler, H.; Leveneur, J.; Murmu, P.P.; Markwitz, A.; Kennedy, J. (2019). "Decorative black coatings on titanium surfaces based on hard bi-layered carbon coatings synthesized by carbon implantation". Surface and Coatings Technology.* ***358****: 386–393. doi:10.1016/j.surfcoat.2018.11.060 (https://doi.org/10.1016%2Fj.surfcoat.2018.11.060) .*

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5. "New welding process opens up uses for formerly un-weldable lightweight alloy" (https://newatlas.com/welding-aa7075-aluminum-alloy/58449/) . newatlas.com. 13 February 2019. Retrieved 2019-02-18.

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